

WHAT IS CLAIMED IS:

1. A method for manufacturing a semiconductor device including steps of forming a wiring by a dual damascene method, the method for manufacturing the semiconductor device comprising the steps of:

forming a cap film, a first interlayer insulating film, an etching stopper film, a second interlayer insulating film, and a hard mask in this order on a conductive layer;

forming a via hole which reaches the cap film in the hard mask, the second interlayer insulating film, the etching stopper film, and the first interlayer insulating film;

embedding an embedded material higher than the first interlayer insulating film and lower than a layered stack composed of the first interlayer insulating film, the etching stopper film, and the second interlayer insulating film in the via hole;

forming a trench whose bottom is higher than an upper surface of the etching stopper film and lower than that of the embedded material in the second interlayer insulating film by etching the hard mask and the second interlayer insulating film, using a resist mask in which an opening for exposing the embedded material is formed;

removing the resist mask and the embedded material;

etching the second interlayer insulating film again by using the hard mask as a mask;

forming a wiring trench by removing the hard mask, and exposed parts of the etching stopper film, and the cap film; and

embedding an electric conductive film in the via hole and the wiring trench.

2. The method for manufacturing the semiconductor device according to claim 1, wherein

a height of the embedded material is adjusted in said step of embedding the embedded material so that a bottom of the trench is lower than the upper surface of the embedded material even if the embedded material is etched when etching the hard mask and the second interlayer insulating film.

3. The method for manufacturing the semiconductor device according to claim 1, wherein the first and the second interlayer insulating films are SiOC group insulation films.

4. The method for manufacturing the semiconductor device according to claim 2, wherein the first and the second interlayer insulating films are SiOC group insulation films.

5. The method for manufacturing the semiconductor device according to claim 1, wherein the etching stopper film and the hard mask are made of an identical material.

6. The method for manufacturing the semiconductor device according to claim 2, wherein the etching stopper film and the hard mask are made of an identical material.

7. The method for manufacturing the semiconductor device according to claim 3, wherein the etching stopper film and the hard mask are made of an identical material.

8. The method for manufacturing the semiconductor device according to claim 4, wherein the etching stopper film and the hard mask are made of an identical material.

9. The method for manufacturing the semiconductor device according to claim 1, wherein the cap film, the etching stopper film and the hard mask are made of materials capable of being removed under an identical etching condition.

10. The method for manufacturing the semiconductor device according to claim 2, wherein the cap film, the etching stopper film and the hard mask are made of materials capable of being removed under an identical etching condition.

11. The method for manufacturing the semiconductor device according to claim 3, wherein the cap film, the etching stopper film and the hard mask are made of materials capable of being removed under an identical etching condition.

12. The method for manufacturing the semiconductor device according to claim 4, wherein the cap film, the etching stopper film and the hard mask are made of materials capable of being removed under an identical etching condition.

13. The method for manufacturing the semiconductor device according to claim 5, wherein the cap film, the etching stopper film and the hard mask are made of materials capable of being removed under an identical etching condition.

14. The method for manufacturing the semiconductor device according to claim 6, wherein the cap film, the etching stopper film and the hard mask are made of materials capable of being removed under an identical etching condition.

15. The method for manufacturing the semiconductor device according to claim 7, wherein the cap film, the etching stopper film and the hard mask are made of materials capable of being removed under an identical etching condition.

16. The method for manufacturing the semiconductor device according to claim 8, wherein the cap film, the etching stopper film and the hard mask are made of materials capable of being removed under an identical etching condition.

17. The method for manufacturing the semiconductor device according to claim 1, wherein

said step of embedding the electric conductive film in the via hole and the wiring trench includes the steps of:

forming a barrier metal film on the surface of the via hole and the wiring trench; and

forming a wiring material on the barrier metal film.

18. The method for manufacturing the semiconductor device according to claim 2, wherein

said step of embedding the electric conductive film in the via hole and the wiring trench includes the steps of:

a step of forming a barrier metal film on the surface of the via hole and the wiring trench; and

a step of forming a wiring material on the barrier metal film.

19. The method for manufacturing the semiconductor device according to claim 17, wherein

said step of forming the wiring material includes the steps of:

forming a seed film on the barrier metal film;
and

forming a metal film on the seed film by a plating method.

20. The method for manufacturing the semiconductor device according to claim 18, wherein

said step of forming the wiring material includes the steps of:

forming a seed film on the barrier metal film;
and

forming a metal film on the seed film by a
plating method.